Compound Statements. (Aug 28–Sep 01)

1. Determine which of the following pairs of statement forms are logically equivalent.

   - \( \sim (p \land q) \), \( p \land \sim q \).
   - \( (p \lor q) \lor (p \land r) \), \( (p \lor q) \land r \).
   - \( p \land (\sim q \lor p) \), \( p \).
   - \( p \rightarrow q \lor r \), \( p \land \sim q \rightarrow r \).
   - \( p \rightarrow q \lor r \), \( p \land r \rightarrow q \).

2. Assume that the following statement is true:

   “If compound X is boiling, then its temperature must be at least 150 degree C.”

Determine which of the following is also true.

   - If the temperature of compound X is at least 150 degree C, then compound X is boiling.
   - If the temperature of compound X is less than 150 degree C, then compound X is not boiling.
   - Compound X will boil only if its temperature is at least 150 degree C.
   - If compound X is not boiling, then its temperature is less than 150 degree C.
   - A necessary condition for compound X to boil is that its temperature be at least 150 degree C.
   - A sufficient condition for compound X to boil is that its temperature be at least 150 degree C.

3. Show that the following is a valid argument form:

   \[ p \rightarrow q \\
   r \lor s \\
   \sim s \rightarrow \sim t \\
   \sim q \lor s \\
   \sim s \\
   \sim p \land r \rightarrow u \\
   w \lor t \\
   \therefore, u \land w \]